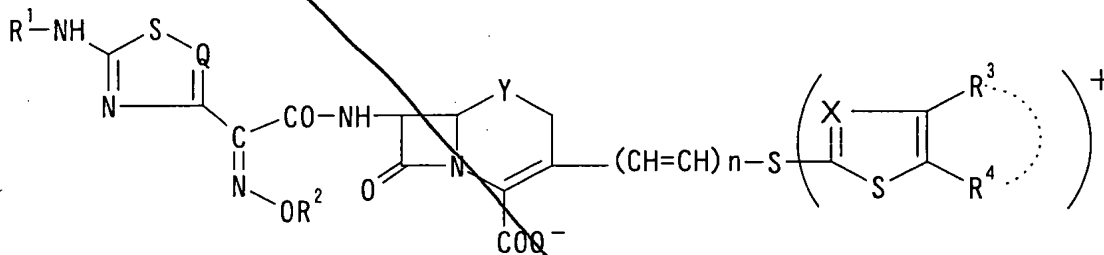


Claims

1. A compound of the formula:



5 wherein R¹ is a phosphono group or a group convertible to a phosphono group; R² is a hydrogen atom or a group having a linkage through a carbon atom; each of Q and X is a nitrogen atom or CH; Y is S, O or CH₂; n is 0 or 1; one of R³ and R⁴ is a pyridinium group which may be substituted and the other is a hydrogen atom
10 or a hydrocarbon group which may be substituted, or R³ and R⁴ taken together may form a quaternalized nitrogen-containing heterocyclic ring which may be substituted, salt or ester thereof.

2. A compound as claimed in claim 1, wherein R¹ is a phosphono group which may be protected.

15 3. A compound as claimed in claim 1, wherein R¹ is phosphono, dialkoxy-phosphoryl, O-alkyl-phosphono, diaminophosphoryl, (amino)(hydroxy)phosphoryl, (alkoxy)(morpholino)phosphoryl or dihalophosphoryl.

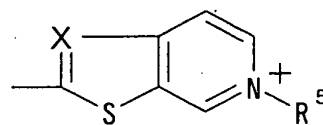
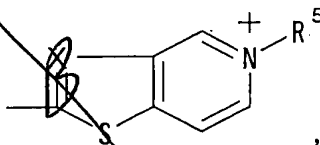
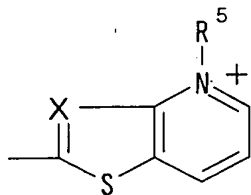
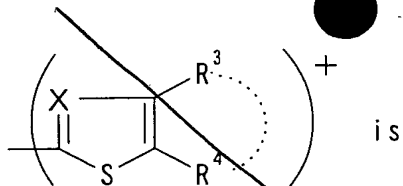
20 4. A compound as claimed in claim 1, wherein R¹ is a phosphono group.

5. A compound as claimed in claim 1, wherein Y is S.

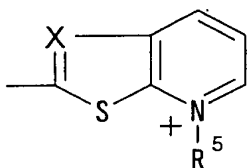
6. A compound as claimed in claim 1, wherein R² is a C₁-₆ alkyl group which may be substituted or a C₃-₅ cycloalkyl group.

8/ 25 7. A compound as claimed in claim 1, wherein R³ is a pyridinium group which may be substituted and R⁴ is a hydrogen atom.

8. A compound as claimed in claim 1, wherein the group of the formula:



or



wherein R^5 is a hydrocarbon group which may be substituted.

9. A compound as claimed in claim 1, wherein Q is a nitrogen atom.

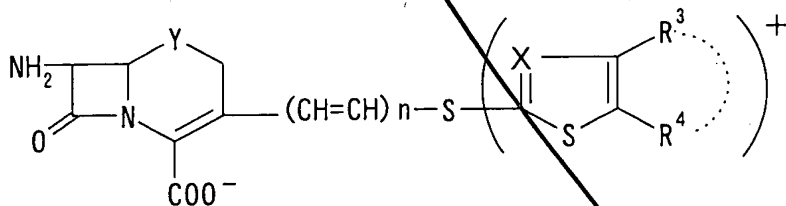
10. A compound as claimed in claim 1, wherein X is a nitrogen atom.

11. A compound ~~as claimed in claim 1~~ according to the above (1), wherein n is 0.

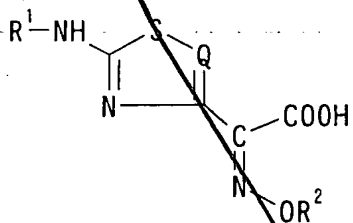
12. A compound ~~as claimed in claim 1~~ according to the above (1), which is 7 β -[2(Z)-ethoxyimino-2-(5-phosphonoamino-1,2,4-thiadiazole-3-yl)acetamido]-3-[4-(1-methyl-4-pyridinio)-2-thiazolylthio]-3-cephem-4-carboxylate, its ester or its salt.

13. A compound ~~as claimed in claim 1~~ according to the above (1), which is 7 β -[2(Z)-fluoromethoxyimino-2-(5-phosphonoamino-1,2,4-thiadiazole-3-yl)acetamido]-3-[4-(1-methyl-4-pyridinio)-2-thiazolylthio]-3-cephem-4-carboxylate, its ester or its salt.

14. A method for producing a compound as claimed in claim 1, which comprises reacting a compound of the formula:

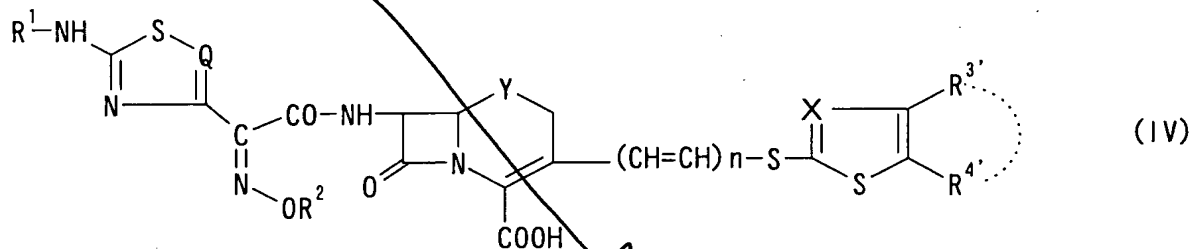


wherein each symbol has the meaning given above, its ester or its salt, with a compound of the formula:



wherein each symbol has the meaning given above, its salt or its reactive derivative, if necessary, followed by converting R¹ to a phosphono group.

- 5 15. A method for producing a compound as claimed in claim 1, which comprises subjecting a compound of the formula:



- wherein one of R^{3'} and R^{4'} is a pyridyl group which may be substituted, and the other is a hydrogen atom or a hydrocarbon group which may be substituted, or R^{3'} and R^{4'}, taken together, represent a nitrogen-containing heterocyclic ring which may be substituted, and the other symbols have the meanings given above, its ester or its salt to the reaction in which quaternalized-ammonium is formed, if necessary, followed by converting R¹ to a phosphono group.
- 10 16. A pharmaceutical composition containing the compound as claimed in claim 1.

17. A pharmaceutical composition containing the compound shown in claim 1 and at least one of pharmaceutically acceptable carriers, diluents and bulking agents.

18. A pharmaceutical composition as claimed in claim 16, which is an anti-bacterial composition.

19. A pharmaceutical composition as claimed in claim 16 which is an anti-MRSA agent.

20. A pharmaceutical composition as claimed in claim 16, which is an injectable composition.

21. Use of the compound as claimed in claim 1 for producing a pharmaceutical composition.

A method of using

A sub
B12

- A method of using*
 22. ~~Use as~~ claimed in claim 21, wherein the pharmaceutical composition is an antibacterial agent.
- A method of using*
 23. ~~Use as~~ claimed in claim 21, wherein the pharmaceutical composition is an anti-MRSA agent.
- A method of using*
 5 24. ~~Use as~~ claimed in claim 21, wherein the pharmaceutical composition is an injectable composition.
-
- ~~25.~~ A method for treating a bacterial infection which comprises administering an effective amount of a compound as claimed in claim 1 to a patient suffering from the bacterial infection.
- 10 ~~26.~~ A method for treating a bacterial infection which comprises administering an effective amount of a compound as claimed in claim 1 together with at least one of pharmaceutically acceptable carriers, diluents and excipients to a patient suffering from the bacterial infection.
- 15 ~~27.~~ A method as claimed in claim ~~25~~ 25, wherein the bacterial infection is a MRSA infection.
- ~~28.~~ A method as claimed in claim ~~25~~ 25, wherein the compound is administered by injection.